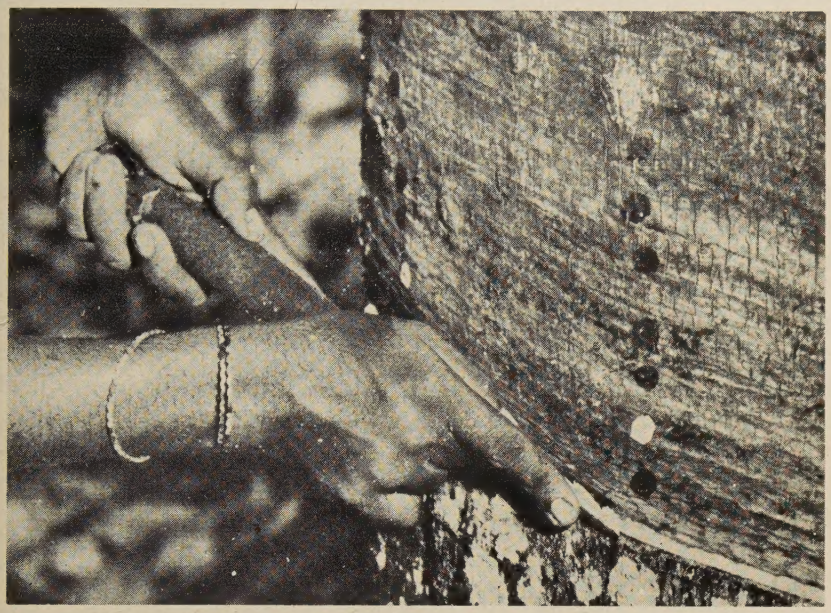
PLANTERS' BULLETIN

OF THE RUBBER RESEARCH INSTITUTE OF MALAYA



NEW SERIES NUMBER NINE

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50 Cents

November
1953

How to keep your PBs

The preliminary pages which accompany this last issue of the year 1953 — Title, Contents, and Corrections — are meant to be placed before issues PB 1 to PB 9 inclusive, and the lot bound together for reference. You are recommended to strip the cover from each issue before binding; care has been taken that no information of reference value will be lost by doing this. The preliminary pages which were issued with PB 3, for 1952, may be discarded unless it is wished to keep the few issues for that year separately.

You will note that we are avoiding volume numbers. Issue number — this issue is PB 9 — and page number are an adequate reference to any article. Page numbering recommences with the first issue of each year.

A special temporary binder for PBs may be obtained from us, price $4.50 post free in Malaya. It is fully bound in green leathercloth with title in gold lettering. A dozen issues can readily be inserted one by one, as they arrive. Each issue is held by an inconspicuous wire and will open flat for ease in reference.

Why not make a deposit for $15 with us to meet future requirements of this nature, and for any additional copies of our publications for your assistants?

Early Issues of the Journal: An Opportunity

As explained in the current list of *Publications of the RRI*, recently distributed, the early issues of the *Journal* are available – while the limited stocks last – at $3 a volume. We are happy to announce that a number of copies of the first issue (Volume 1, Nos 1 & 2, January 1929) are again available separately, at the original cost of $1 each. Contents of this issue include a summary of the initial development and work of the institute, and papers on silt pitting, preliminary studies on diseases of cover crops, pollination of *H. brasiliensis*, budding correlation of yield and vegetative factors, South American leaf blight, manuring, *etcetera*. Copies of Volume 3, No. 2 (October 1931) are similarly available, at $1 each. This issue contains substantial contributions on manuring.

We will gladly refund cost and postage for numbers out of stock: Volume 7, Nos. 1 and 2; Volume 8, Nos. 2 and 3; Volume 9, No. 1. Can any reader please help?

PLANTERS' BULLETIN
OF THE RUBBER RESEARCH INSTITUTE OF MALAYA

Kuala Lumpur November 1953 New Series No. 9

Editorial: History of Tapping

This issue introduces the first of a series of articles which will cover all aspects of tapping, including slaughter tapping. Our introductory article brings together much information which is to be found scattered throughout the literature, and it is hoped that it will provide a useful reference for the more experienced planter, and a source of general information for the younger generation of men who have made planting their career.

A short historical account of the development of tapping, the basic operation of rubber production, is therefore timely in this Editorial.

The Brazilian practice of extracting latex from wild hevea trees consisted of making numerous small oblique incisions in the bark by means of a tapping axe with a long handle, a small wedge shaped head and a cutting edge about one inch long, and then collecting the latex in small tin cups fixed beneath each incision by means of clay. An older method was to allow the latex to run down the bark and along a sloping gutter at the base of the tree into a calabash.

At each tapping, incisions were made at roughly equal distances from each other in a ring around the trunk. Each ring was made below the previous one, from the highest level attainable to the base of the tree. A second series of incisions was then made midway between the rings of the first series and so on. The horizontal distance between the cuts seemed to vary from 4 to 15 inches and the vertical distance between the consecutive rings from 2 to 12 inches. Tapping began at day break and lasted four to five hours. The trees were tapped for 160 days continuously and then rested for six months. The drastic treatment resulted in scarring and in uneven growth of the stem.

When the first rubber trees planted in the East reached the bearing stage planters had little idea how to extract the latex. The first tapping in the East was done in 1882 by Dr H. Trimen (Director of the Botanic Gardens, Ceylon), at Henaratgoda, where the first rubber seedlings introduced into Ceylon in 1876 had been planted. It consisted of a few short cuts with a knife. Experimental tapping was resumed by Trimen in 1888 on one of the largest of the original trees, using a modification of the Brazilian method of small incisions; it consisted in making gashes in the bark with a hammer and chisel. The tree was very lightly tapped in alternate years up to 1896 and for nine years gave an average annual yield of $1\frac{1}{2}$ lb of dry rubber.

Other methods of incision were tried in Ceylon. Small V-shaped cuts spaced about 6 inches were made round the trunk by means of a carpenter's chisel, 1 to $1\frac{1}{2}$ inches wide, and a mallet; pricks were made in the bark with the rotating spur shaped pricker introduced by Bowman and Northway in 1905. Such incision methods succeeded the system

of general slashing and were designed to extract latex without removal of bark, but they all led to considerable wounding which resulted in swollen trunks covered with growths of burrs, rendering the bark useless for further tapping.

The Director of Singapore Gardens, Mr H.N. Ridley, tapped trees in 1889 on the herring bone system, which consists of oblique cuts running into a central vertical channel. He used a narrow flat chisel and by striking it with a mallet removed shavings of bark from the lower side of the oblique cuts. Thus was born the method of excision in which a thin shaving of bark is removed from the lower side of the original groove at each tapping, and which is in general use today. Caution, however, prevailed as fearing the wounds would not heal Ridley ceased reopening the cut when the tapped bark reached a width of half an inch and opened a new oblique cut of the herring bone in virgin bark.

Trials with the herring bone system were continued in Singapore Gardens and were also carried out at Waterfall Gardens Penang (1896), at Taiping (1897), at Kuala Kangsar (1897), and at the Perak Rubber Plantations, Sitiawan (1901-1902) where the carpenter's chisel was discarded in favour of a sharp pruning knife.

It is clear from the literature that the tapping implements then available were ill suited for their task.

The carpenter's gouge came into use at Bukit Lintang Estate and later the number of re-openings of the same cut increased from 14 to 24. It was not until 1906 that a modified farrier's knife, as used by Wray in his tapping trials in 1897, was adopted in the Singapore Gardens. It is interesting to note that much later this type of knife was used by the manager of Jebong Estate and has since been known as the Jebong knife. The simplest tools were preferred in Malaya, in contrast with Ceylon where more complicated types of knife found favour.

Bark paring systems used in the course of the evolution of tapping systems included the herring bone and its variants, the superimposed V cuts on a half circumference separated by a vertical distance of one foot, the full spiral system in which one or more similar cuts extended right round the tree girdling it more than once, each spiral cut draining into a separate collecting cup, and the basal Y.

From the multiple cut systems evolved the single cut system, either V or spiral, on half the circumference of the tree. This, tapped on alternate days, is the present standard system; the trend throughout has been to reduce the severity of tapping and to prolong the economic life of the tree.

R. R.I. News

Two of our oldest experiments on full circumference tapping continue in recording. The yields of seedling trees on the double four and full spiral fourth daily tapping systems have been maintained since 1935. On budded trees the double four system has resulted, since 1939, in a loss of yield (relative to the half spiral alternate daily system) for all clones except AVROS 50. The biggest loss in yield – 32% from 1937 to 1952 – is shown by clone AVROS 49.

Tapping: An Introduction

TAPPING HAS BEEN DESCRIBED as controlled wounding. It consists in removing at regular intervals thin shavings of bark from the lower surface of a groove made into the bark to a depth of about 1 mm from the cambium, the object being to open the ends of the latex vessels blocked by plugs of coagulated latex and so permit the free flow of latex from vessels. The shavings of bark removed should be sufficiently thick to open all the latex vessels along the tapping cut – but no thicker if unnecessary wastage of bark is to be avoided.

The tapping knives in common use in Malaya are the gouge and the jebong. Gouges $\frac{1}{2}$ to $\frac{5}{8}$ inch in width are suitable for tapping seedling trees but for budded trees a $\frac{3}{8}$ inch gouge is more satisfactory. For the best results it is essential that the edges of the blades are kept sharp and that the bark shavings removed are of an even thickness. An expert tapper will tap to an even depth along the whole length of the tapping cut but an unskilled tapper will pare bark of uneven thickness and although the average thickness of the bark shavings may be the same as that of the skilled tapper the maximum yield will not be obtained.

A golden rule of tapping is that the rate of bark consumption should not exceed the rate of bark renewal. Another is to take a long term view, to consider the future health and yielding capacity of the trees rather than to aim at large and quick returns regardless of consequences.

The common practice of referring to the tissues external to the wood collectively as bark is followed in this article although botanically speaking only the outermost layer of cells consisting mainly of cork constitutes the true bark.

ANATOMY OF BARK

Three main layers can be distinguished in a cross section of bark (*a*) an inner layer, or soft bast derived from the cambium and consisting mainly of parenchyma cells in which are embedded rings of sieve tubes and of latex vessels, the latter being arranged into a series of concentric cylinders of interconnecting vessels pierced at intervals by medullary rays which are bands of tissue running radially through the stem connecting the wood and the bark; (*b*) an intermediate layer, or hard bast — which in budded trees may be half the total thickness of the bark — consisting of a mixture of soft tissue and clusters of harder elements known as stone cells separated by the phellogen or cork cambium from (*c*) the outer protective layer of cork cells.

The latex vessels are confined to the layer of soft bast and the innermost layer of stone cell zone of the hard bast, as shown in the bark diagram.

Anatomical characters in relation to tapping practice — On seedling trees the non latex bearing corky layer represents one third to one half of the total bark thickness, while in budded trees of most clones it may be not more than 10 per cent. The total thickness of the bark is thus higher in seedlings than in buddings although there is a heavier development of the stone cell layer in the latter. The thickness of the latex bearing zone is approximately the same for both.

The stem of a typical budded tree is cylindrical whereas that of a seedling tree shows a pronounced taper from ground level to a height of

about four feet where the trunk becomes cylindrical up to the level of the first branches. The difference in girth immediately above the union and at 40 inches in budded trees is seldom more than 10 per cent and the difference in total bark thickness seldom exceeds 15 per cent, while in seedling trees the girth at ground level may be double the girth at a height of 40 inches. In buddings the number of latex vessel rows at the base of the tree is only about 15 per cent greater than at 40 inches, while in seedling trees the difference may amount to 50 per cent.

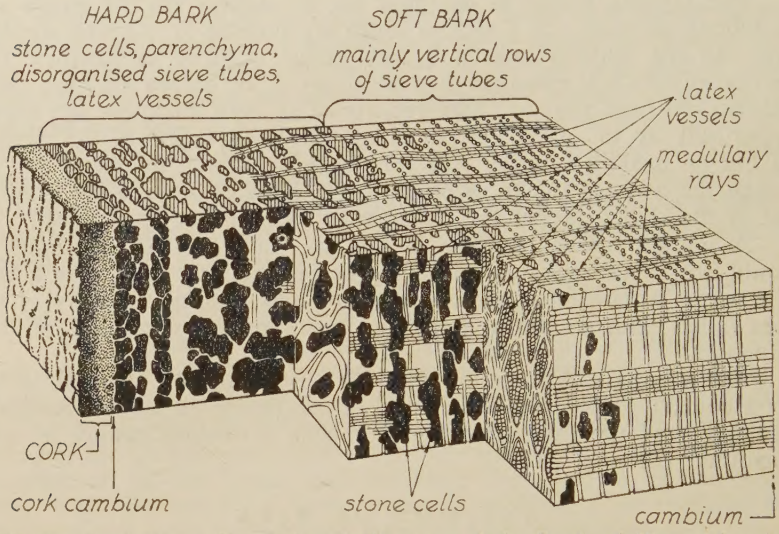

Figure 1. A three dimensional diagram of the bark of Hevea brasiliensis. The sieve tubes, which make up the bulk of the soft bark, are not shown. Nor is the parenchyma shown, i.e. the cells which constitute the soft supporting tissue in both soft and hard bark. The black areas are clusters of stone cells.

For these reasons, and because in seedling trees the bark is thicker and bark renewal better with decreasing distance from the base of the tree, the best yields are obtained by tapping at the lowest level consistent with adequate bark renewal. The rate of increase in yield as the tapping cut approaches the base of seedling trees is approximately 15 per cent per foot. In budded trees the yields do not increase as the tapping cut approaches the union but may actually decrease.

PHYSIOLOGY OF LATEX FLOW

Latex is a milky fluid containing the rubber hydrocarbon in the form of small globules each stabilised by a skin of soaps and proteins, floating in an aqueous solution containing proteins, amino acids, carbohydrates and various electrolytes.

Latex vessels are living cells provided with a lining of cytoplasm and the flow of latex on tapping is due to the release of internal pressure at the cut ends of the vessels, which are squeezed under the pressure exerted by the surrounding turgid cells. Latex is therefore

forced out and the reduction in pressure extends progressively along the length of the vessel leading to a flow of latex towards the cut; at the same time the drop of internal pressure of the vessels leads to dilution of the latex as water flows into the latex vessel from the surrounding intact cells. After the cut has closed, turgor pressure is again built up in the latex system until an equilibrium is attained with the surrounding cells and the latex is restored to its original concentration.

Recent work at this Institute has shown that when a tree is tapped for the first time, or after a period of rest, the effect of tapping is not confined to an area close to the tapping cut but may extend throughout the whole tree. In an untapped tree the dry rubber content of the latex is of the order of 60 per cent. The first tapping yields a small quantity of very viscous latex. Subsequent tappings yield an increasing volume of latex of progressively decreasing rubber content, and after a number of tappings the yield reaches a more or less constant level and the rubber content remains at an average level of about 30 per cent by weight of the total latex.

During any one tapping the rate of flow of latex is not constant; it is rapid at first, then gradually slows down to a more or less steady rate which lasts for the greater part of the period of flow before diminishing to a stop. The flow of latex may last as long as two or three hours, the latex collected during the early period of flow (10 to 30 min.) becoming progressively more dilute and that collected during the later stages of flow showing a more nearly constant dry rubber content.

The continuous formation of rubber by the tree occurs only in response to tapping or, in other words, as a result of the lowering of the concentration of latex in the vessels.

Area of bark affected by tapping — Frey Wyssling's calculations of the area of bark involved in tapping showed that latex flows sideways, towards the cut, from a distance corresponding to one ninth of the vertical distance. The latex is drawn from an area of bark below the tapping cut, which in a high yielding tree may extend to a distance of over four feet, but part of it is drawn from areas of bark on each side of the tapping panel.

The present concept of the effect of normal continuous tapping of a high yielding tree is that the area of bark involved in the latex flow extends to the whole lower portion of the stem, to a height of at least six feet from the ground.

In a tree tapped for the first time the area of bark involved, as shown by changes in concentration of the latex, may extend to the branches of the crown with regeneration of latex taking place to some extent throughout the whole latex system, but there is no evidence to show that the effect of continuous tapping is transmitted throughout the latex system of the tree.

BARK CONSUMPTION AND BARK RENEWAL

The rate of bark consumption will depend much on the skill of the tapper. An expert tapper would obtain maximum yield on alternate daily tapping with a bark consumption of $\frac{3}{4}$ inch per month ($\frac{1}{20}$ inch per tapping) but with the average tapper, especially the contract tapper, a consumption of $\frac{7}{8}$ inch or 1 inch per month ($\frac{1}{17}$ inch or $\frac{1}{15}$ inch per tapping) may be expected.

The commonest method of checking bark consumption in Malaya is for the tapper to put black spots on the newly tapped surface of the bark on the sides of the panel at the end of each month and red spots at the end of each year. The spot marks are made with an asphalt/kerosene mixture, or with Shell tree dressing, a petroleum product which does not contain corrosive chemicals.

A bark consumption of say 10 inches a year would allow 8 years for first renewal in budded trees opened at 40 inches from the union on all panels and over 7 years for seedling trees opened on successive panels at 22, 32 and 42 inches from the ground. Under ideal conditions complete renewal should be obtained in six years but since conditions are seldom ideal a period of seven years should be allowed for renewal on the first panel and eight years on the second panel. Bark of less than 5 years' renewal is often tapped on heavily tapped holdings but this is considered a bad practice likely to impair the future production of the trees.

Renewed bark should preferably be not less than 7 mm in thickness for commercial tapping but the state of maturity of the bark may sometimes be a more important criterion than the actual thickness.

Bark regeneration is brought about by the activity of the cambium. The rate and extent of renewal are determined by a number of factors of which the most important are the inherent properties of the planting material (such as vigour of growth and thickness of virgin bark), the fertility of the soil, the planting distances, the tapping system and tapping intensity and, in seedling trees, the distance from the base of the tree.

The thickness of renewed bark measured with a Schlieper's bark gauge* is on the average about 75 to 80 per cent of the thickness of virgin bark, at the end of the third year; by the end of the fourth year, or sometimes earlier, the full complement of latex vessel rows characteristic of the virgin bark is restored. The rate of renewal slows down considerably after the third year and renewed bark which has a smaller development of the stone cell layer seldom attains the thickness of virgin bark.

Standard of tappability

a of a planting: at least 70 per cent of the trees should have reached the standard girth suitable for tapping;

b of trees (for half circumference alternate daily tapping): a girth of 20 inches at 20 inches from the ground for seedlings, or at 40 inches from the union for budded trees.

The standard girth for full spiral tapping is 28 inches at 40 inches from the union for budded trees and 24 inches at 36 inches from the ground in seedlings.

The girth is always measured at the height of opening of the first panel.

Sequence of panels — The normal sequence for budded trees is 40 inches from the union for the first and subsequent panels and that for

* *The Schlieper gauge consists of a brass tube through which passes a steel plunger with a wedge shaped end, like a screwdriver. The blade is pushed into the bark, when the penetration can be read off to the nearest half millimetre.*

seedling trees is 20, 30 and 40 inches respectively for the first, second and third panels. Where bark consumption on alternate daily tapping is appreciably in excess of 10 inches per year it would be advisable to add 4 to 5 inches to the opening heights normally recommended for each panel.

The different heights of opening of the first three panels on seedling trees — which allow the trees to come into tapping at least one year earlier than they would if the first panel were opened at 40 inches, and which on the first two panels keep the tapping cut on the most productive area of the seedling bark — have certain disadvantages in that yields on the third and fourth panels may show a serious decline and a number of trees may go dry as the tapping cut approaches the junction of virgin and renewed bark. The extent of the drop in yield in the region of separation between bark of different ages seems to depend on the quality of the renewed bark, for where bark renewal has been exceptionally good there has been little indication of a drop in yield.

The need to tap over separation zones would not arise if the first panel were opened at an initial height of 40 inches from the ground, but the loss of yield by delaying tapping at least one year and by tapping seedling trees at such a high level during the early years would outweigh any advantages arising from the unusually high level of opening.

Angle of slope of cut — For seedling trees, in which the presence of a thick cork layer in the bark provides a wide channel for the flow of latex at tapping, the angle of slope of cut should be 25 degrees from the horizontal. For budded trees, in which the total bark thickness is less than in seedlings, the latex may overflow down the sides of a tapping cut with a 25 degrees slope, and for this reason an angle of slope of 30 degrees from the horizontal is recommended.

The tapping cut is usually made to slope from high left to low right as the latex vessels in the bark are inclined to a slight angle of about $3\frac{1}{2}^{\circ}$ to the right, and consequently a greater number of latex vessels is cut per unit length of tapping cut if the slope is left to right than if it is right to left. Experiments have shown that yields from left to right cuts are greater than those from right to left cuts by about 8 per cent with a slope of cut of 25 degrees and by about 14 per cent with a slope of cut of 45 degrees.

A V cut, therefore, which is a combination of left to right and right to left cuts, should theoretically give a lower yield than a spiral left to right cut, both types being on a half circumference.

The V cut is easier to tap on large trees where it is more easily kept on an even slope and there is less likelihood of spilling of latex. It is better suited to seedling trees, especially older trees of a large size, as its mean height is less than that of a half spiral cut; the bigger the tree the greater is the difference in mean height of the two types of cut.

Depth of tapping — Too deep tapping is conducive to wounding of the cambium, resulting in irregularities of the renewing panel, and to damage of the soft tissues by sun scorch. It is necessary in practice to observe the 'tapper's margin' of about 1 mm from the wood.

Deep tapping yields a latex of lower dry rubber content than shallow tapping. Shallow tapping has nothing to commend it as by opening fewer latex vessels it results in a considerable loss of crop.

Time of tapping — It is well known from estate practice that the yield of rubber trees falls off rapidly from dawn to later in the morning, the average difference in yield from a number of experiments being about 16 per cent between tappings made at 6.00 a.m. and 10.00 a.m. The explanation is that the turgor of the trunk is much reduced as the day temperature rises, owing to loss of water by transpiration.

It is suggested that reversing the order of tapping in tasks on alternate tapping days would equalise the strain on the trees and might result in a decrease in brown bast incidence.

Change of panels — Simultaneous turn over of panels makes for ease of supervision and efficient control of tapping and bark consumption; the effect on total crop can be accurately forecast, but in seedling areas it results in a sudden drop in crop and is often attended by factory difficulties in dealing with latex from new cuts.

Bark consumption rates on all trees are not completely uniform because of differences in hardness of bark and the varying skill of tappers, so that simultaneous change of panels in seedling areas would result in valuable bark at the base of a number of trees being left untapped.

In seedling areas a gradual turn over, as cuts run out, will ensure the best use of the most productive bark at the base of the trees and, by spreading the change of panels over a period of several months, will reduce the difficulties of a sudden drop in crop and the factory difficulties of 'new cut' latex.

The disadvantages of simultaneous turn over in budded areas are not as great as in seedling areas as the bark at the base of a budded tree is relatively less valuable than that at the base of a seedling tree. It will generally prove profitable to turn over before the tapping cuts reach the union.

EFFECT OF TAPPING ON GROWTH

All systems of tapping retard the rate of growth, those that give the highest yields producing the greatest retardation. A good example of this adverse effect of tapping on growth is available from Field 5 of the R.R.I. Experiment Station, in which nine clones are represented. In this field, planted in 1929, the corner trees of each plot arranged in a statistical design have not been tapped and in 1945 their mean girth was 6.3 inches more than that of the tapped trees. This difference had increased to 8 inches in 1952.

Increase in tapping intensity within certain limits results in increased yield. In old trees this increased yield is mainly at the expense of food reserves — in young trees it is at the expense of growth. When rubber is being lost more rapidly than it can be replaced the dry rubber content of the latex will decline and this will be the danger signal for an outbreak of brown bast.

Undertapping, however, is nearly as big a mistake as overtapping as crop is lost because the trees only continue to manufacture latex in response to tapping.

When considering tapping systems important factors are yield and its effect on the growth and health of the tree, rate of bark consumption, and tapping costs.

Economy of tapping has for its object an increase in yield per tapping.

INTERNATIONAL NOTATION FOR TAPPING SYSTEMS

A standard nomenclature for tapping systems, using standard symbols to designate general groups and classes of tapping and discarding ambiguous symbols which had acquired different meanings in different countries, was first published in 1939. It was revised six months later and simplified by reducing its basis to a single convention through the use of fractions of the time cycle of each feature, *e.g.* by describing length of cut as fraction of the circumference of the tree, alternate daily tapping as tapping on half the total days. fourth daily tapping as tapping on the quarter of the total days *etc.*

The basis of this international notation, published as a revised version in May 1940, is to state the amount of tapping as a fraction of daily tapping on a full circumference. Alternate daily tapping on half circumference, equivalent to an average of a quarter cut tapped per day, is taken as standard (100%) in estimating relative intensity and is represented by the formula S/2.d/2.100%.

Relative intensity is expressed as a percentage of standard intensity on half spiral alternate daily tapping and to calculate relative intensity it is necessary to multiply out the fractions of the formula and then to multiply the product by 400. On the standard system of S/2.d/2.100% the product of the fractions is $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ and as this arbitrary standard system is taken as 100% intensity, multiplication by 400 is required in each case to find relative intensity.

A few examples will make this clear:

		Relative intensity
S/2.d/2	$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$;	multiplied by 400 = 100%
S/1.d/4	$\frac{1}{1} \times \frac{1}{4} = \frac{1}{4}$;	multiplied by 400 = 100%
2S/2.d/4	$\frac{2}{2} \times \frac{1}{4} = \frac{1}{4}$;	multiplied by 400 = 100%
S/2.d/2.12m/16	$\frac{1}{2} \times \frac{1}{2} \times \frac{12}{16} = \frac{3}{16}$;	multiplied by 400 = 75%
S/2.d/3	$\frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$;	multiplied by 400 = 67%
S/2.d/2.6m/9	$\frac{1}{2} \times \frac{1}{2} \times \frac{6}{9} = \frac{1}{6}$;	multiplied by 400 = 67%

The full revised notation is described in detail in Communication No. 247 of the Journal of the Rubber Research Institute of Malaya, Volume 10, pages 26-33.

Tapping systems in general use on estates in Malaya will be described in the second article of this series.

Reprints of this article may be obtained on request.

BOTANICAL DIVISION

R. R. I. News

Technological properties of smoked sheet prepared from the more important of the RRIM '500' series of clones have been investigated. RRIM 501 gives a soft raw rubber. Scorchy rubbers are obtained from RRIM 526 and RRIM 527.

Fertiliser Treatment and Maintenance for Young Replantings

REGULAR MANURING OF YOUNG REPLANTINGS has become a standard practice on most soils in Malaya and the manuring recommendations of the Soils Division for average inland soils are set out in the schedule of manuring given later in this article. The recommendations are intended to be a general guide rather than a schedule which has to be rigidly followed, and according to local conditions some adjustments and modifications to the schedule may be required.

On coastal clay soils and peat-over-clay soils, manuring should not normally be necessary, but rock phosphate (application No. 1 in the schedule below) may be used in the planting hole and possibly once during the first year of growth if depletion of nutrients is feared because of previous heavy food cropping, exhaustion by lalang *etc.*

When preparing basket plants, a 'pinch' or level teaspoonful of rock phosphate ($\frac{1}{8}$ oz) may be mixed with the soil in the top half of the basket. The application listed for seedlings and basket plants 'At 1 to 2 months' after planting is intended to be made when two mature whorls of leaves have developed.

The need for further manuring after application No. 7, 'At 4 to 5 years' from planting, can be decided from the condition and general development of the plants at that age. Similarly, if plants are backward during the first year and budding is likely to be delayed, an additional dressing of fertiliser about 9 months after planting may be given.

SCHEDULE OF MANURING (INLAND SOILS)

	Time of application after planting or budding		*Fertiliser mixture*		*Quantity per point*
	Seedlings and basket plants	*Budded stumps & field budgrafts*	*Loam to clay loam*	*Very sandy*	
1.	In planting hole		Rock phosphate		4oz in top 8 inches
2.	At 1-2 mths	*	M	X	4oz
3.	At 6 mths	At 4-6 mths	M	X	4oz
4.	At 12 months		M	X	8oz
5.	At 2 years		M	X	14oz
6.	At 3 years		M	X	1 lb 6 oz
7.	At 4-5 years		C	Y	2 lb 12 oz

* *For field budgrafts prior to budding in the field, manure as for seedlings and basket plants up to and including the treatment at 6 months.*

COMPOSITION OF FERTILISER MIXTURES

Mixture	*Sulphate of ammonia (21%N)*	*Christmas Is. rock phosphate (36-38%P_2O_5)*	*Muriate of potash (60%K_2O)*	*N* %	*P_2O_5* %	*K_2O* %
M	47	47	6	9.9	17.4	3.6
C	65	35	–	13.6	12.9	–
X	44	42	14	9.2	15.5	8.4
Y	56	30	14	11.8	11.1	8.4

Fertiliser should be applied around the plants in annular bands near the limits of root development, at distances gradually increasing from within a few inches of the plants up to three or four feet away. The fertiliser should be lightly scratched into the top two or three inches of soil. Later applications from the fourth or fifth year onwards may be given in pockets, using at least six or eight pockets per plant.

BACKWARDNESS

Backwardness in young replantings may develop through the extensive though irregular occurrence of poorly grown plants which have weak foliage accompanied by varying degrees of defoliation. The loss of foliage and the temporary dormancy of the terminal bud stimulates the shooting of the lateral buds and results in a characteristic appearance when the lateral shoots have developed.

In some instances leaf discoloration has been noticed and can frequently be associated with magnesium deficiency, as shown by leaf analysis. This can be relieved, or at least partially corrected, by applying magnesium fertilisers. The discoloration usually appears as intervenal yellowing or chlorosis of the lower leaves, though in more severe cases all leaves of the plant may become affected. Bronze colours and necrosis of the leaf tips and edges may result, and defoliation may be the culminating stage of this leaf disorder.

The yellowing of leaves varies considerably between estates and planting materials, both in regard to the amount of discoloration and also the nature of the yellow colour. Leaf analysis suggests that the discoloration may be due to lack of magnesium but potash deficiency may also be involved on sandy soils, and unless both deficiencies are corrected the lack of the unsupplied nutrient may be enhanced by the extra quantity supplied of the other. For example, on a sandy soil, extra potash has failed to relieve the leaf discoloration, and analysis of the leaves showed that magnesium was still deficient, although the potash content had been raised to its normal level.

Exact information is not available regarding the effectiveness and the amounts required of magnesium fertiliser to remedy established cases of magnesium deficiency, but the usual practice is to apply 4 oz or 8 oz of magnesium limestone per plant.

Poor growth and backwardness in replantings may not be associated with any specific foliage discoloration, and in such instances may be linked with the rainfall conditions and the cultivation history of the area.

When replanting has been done in 'disturbed' soil, several unsatisfactory features may arise. Disturbed soil may be the result of operations during the cultivation of food crops or during the eradication of lalang. Changkolling or tractor cultivation when given several times to the same area of soil leads to erosion losses and the finer clay particles in the surface soil, over three to six inches depth, may disappear. A noticeably sandy to sandy loam surface layer of soil, which has a lowered fertility, is often the result.

A more unattractive feature of a sandy surface soil is its poor water holding capacity and consequently its wide day to day fluctuations in moisture content. For young seedlings which are endeavouring to establish new and delicate roots any tendency to dryness in the topsoil is most unfavourable, and root formation is both retarded and diverted to the next lower soil horizon which has a higher moisture content.

If roots have not developed in the upper four to six inches of soil, surface applications of fertiliser, which include the relatively insoluble rock phosphate, will have little effect on the young rubber plants which principally require phosphate nutrition. Representative plants should be examined carefully from time to time to check the extent of root development, and where roots are appearing below a sandy surface layer, it will be an advantage to 'place' the fertiliser at four to six inches depth. This can conveniently be done by using a pointed stick about an inch in diameter to make holes around the plants, into which the fertiliser can be apportioned. Ordinarily, however, placement of fertilisers for rubber under three years of age is not a desirable practice because roots are only sparsely developed, and fertilisers placed at several points may completely miss the areas in which roots are growing.

To help stimulate the growth of plants which have been stagnant for some time, quick acting phosphatic fertilisers containing superphosphate in place of rock phosphate may be employed in the fertiliser mixture.

COVERS AND WEEDING

Much post-war replanting has been carried out with very limited funds, and one economy measure which has been practised concerns cover crop policy. Legume cover seeds, which have been expensive and scarce, have either been omitted or sown very thinly in replantings. Insufficient phosphate manuring of the covers has been done, and the weeding policy has not been vigorous enough to suppress other competing covers. As a result frequently the ground cover has consisted principally of grasses, which, although better than no covers at all, lead to several undesirable consequences, particularly when circle weeding has been adopted.

Strip weeding is preferable to circle weeding and, although the latter may be cheaper at first, there is little difference in cost when the strip weeding system has become established. Strip weeding will help to produce better grown rubber plants, and later fertiliser applications

can be placed along the tree rows or terraces with a minimum loss due to poaching by the competing covers.

Circle weeding invariably means scraping weeds off the surface of the soil, using a changkol and working from the rubber plant to the circumference of the clean circle. This procedure is likely to sever rubber roots which are in the surface, and to make for deeper rooting. At the same time, a minimum of severance of cover crop roots is obtained on the edge of the circle. Soil scraped away from the rubber plants is built up into a small rampart at the circumference, leaving a depression towards the centre. Such a depression may concentrate the rain and maintain abnormally high soil moisture contents for long periods in the zone of root development. There is every likelihood, under these conditions, of insufficient air (oxygen) supply being available to the growing roots, which will be severely checked, thereby possibly causing defoliation.

If circle weeding is done in alternate months in outward and inward directions, the disadvantages listed above will be minimised, but in practice this alternation is not often achieved.

Further, the growth of the covers is not retarded sufficiently and undue competition with the rubber plants is likely to occur, particularly for fertilisers applied near the circumference of the weeded circle. Grasses in particular which have a closely matted shallow root system compete strongly for plant foods and return little debris to the soil. In this respect they must be ranked as inferior to legume creepers whose roots penetrate a much larger volume of soil and which 'fix' atmospheric nitrogen as well as providing a considerable quantity of organic debris for the soil. Legume creepers should only be omitted from the scheme of covers if their establishment presents undue difficulties, and a system of strip weeding should be followed from the start.

Mulching with cover clippings and plant debris around the young plants during the first year after planting will assist growth by maintaining a more even moisture content and a lower temperature in the surface soil.

It is difficult to assess by eye the exact degree of development of a young clearing and our recommendation is that annual growth measurements, preferably girths, be taken at a standard height of 60 inches from the union or from the ground on a number of consecutive plants in several rows in typical parts of the field. About five per cent of the total is a suitable number to measure, selected in groups of at least twenty consecutive plants. The plants should be marked and numbered so that each one may be measured at exactly the same height each year.

Reprints of this article may be obtained on request. It replaces Circulars 30 and 31, and the leaflet S. AL 11/50 which is mentioned in Communication 267 (p. 199) of the Journal of the Rubber Research Institute of Malaya. See also the article, 'Manuring of Young Rubber Plants' in PB 4, for relevant discussion with particular reference to the special requirements of nurseries.—Editor.

SOILS DIVISION

Yields from Clones and Selected Seedlings in Commercial Tapping

BEFORE THE WAR the Botanical Division was collecting yields of planting material obtained under commercial tapping on estates. This work was taken up again after the war but the number of estates supplying information has only been small and it has not been possible to make any clear interpretation from the data available. The object of this note is to invite the cooperation of all estates and agency houses in helping us to collect a far larger amount of information which we know exists but which for want of collation is not of general use to the industry.

The information which we require is briefly as follows; for each clone or selected seedling family for which reliable yield records are available:

1. *Planting History*

   Date of planting and/or budding
   Whether new planting or replanting
   Acreage
   Planting density, points per acre and spacing
   Present stand, points per acre
   Soil type:
   Coastal – clay with less than 1 ft of peat, or no peat
   clay with more than 1 ft of peat
   Inland – sandy loam
   clay loam
   lateritic soil with hard stony material within 1 ft of surface
   Drainage: if coastal, how many rows of trees sited between each drain, counting aeration and main drains
   when draining was carried out
   Topography: flat, undulating, hilly

2. *Tapping History*

   Date of opening for tapping and height of panel
   Date of panel changes and heights of opening
   Tapping system

3. *Record of Yield*

   Annual, quarterly or monthly yield in lb per acre.

When details under 1 and 2 have been given to us, they need not be repeated with each return of yields. Any changes that occur should of course be notified. With regard to the record of yield it may be convenient to submit back records as annual figures. For current yields we would be glad to receive a copy or an abstract of monthly or quarterly field yield statements.

The source of information supplied will be treated as confidential, but we wish to be free to use the information for assessment of the potentialities of planting material for advisory and research work.

May we have your help?

BOTANICAL DIVISION

Correspondence

The Editor of PLANTERS' BULLETIN *invites letters of general interest for publication in this column. Comment and queries arising from articles recently published will be welcome. The name and address of the writer must be given in full, but may be withheld from publication if desirable.*

o

AIR DRIED SHEET

We do not know whether the article in PB 8 will encourage estates to produce this type of rubber known in the trade as 'pale amber unsmoked sheet' but it might be wise to sound a warning that the premium over RSS 1 has been reduced considerably during the last few months. In January this year we obtained a premium of 8 c per lb but this is now down to 3 c per lb and as the differential between first latex crepe and RSS 1 is narrowing, the demand for the pale amber unsmoked sheet is diminishing. It is true that the unsmoked sheet when ready for baling, and if unsaleable, can be easily smoked in the smokehouse but this entails additional expenditure in handling and these days of low market prices even a fraction of a cent per lb makes a visible difference to an estate's cost.

J.A. Wattie & Co, Ltd
A.E. Taylor
Manager

R. R. I. News

Evidence of a lateral translocation, when the normal channels of conduction are severed by tapping to the wood, has been experimentally confirmed in full spiral tapping.

A satisfactory technique has been evolved for growing micro organisms normally present in latex. A study of the characteristics of some of the more prevalent organisms has been commenced.

Mould Growth on Sheet and Crepe Rubber

Mould rarely develops in smoked sheet because of the antiseptic substances added by the smoke, but air dried sheet and crepe must be carefully prepared to avoid contamination or must be treated with a fungicide.

Paranitrophenol is the most efficient and economical fungicide for rubber but unfortunately it gives a yellow water extract. This staining prohibits its use in crepe which is employed in surgical and light coloured articles. This problem has been much discussed in recent issues of the *India Rubber Journal* and in the issue of 25 July 1953 (p 4) A.S. Cook and K.C. Sekar of our Chemical Division have summarised the work done by the R.R.I. in the search for new fungicides.

Only a few of the chemicals tried were as effective as paranitrophenol. Thallium nitrate, phenyl mercuric nitrate, and mercuric chloride were effective at the same concentrations, but these substances are poisonous. The amount of sodium pentachlorphenate and of the sodium salt of salicylanilide required to give adequate protection against mould growth is ten times the amount of paranitrophenol required.

The conclusion is that no new fungicide has yet been found which is more suitable than paranitrophenol for the prevention of

mould growth on sheet rubber. Because of the probability of staining, paranitrophenol should not be used in crepe. If manufacturers object to the use of paranitrophenol in sheet rubber other fungicides could be used at a much higher cost. It may be that mould growth is more acceptable than the alternatives.

The Yellow Tea Mite

THE ONLY MITE IMPORTANT AS A PEST of rubber is the yellow tea mite, *Hemitarsonemus latus*. It is common throughout Malaya, both in nurseries and on mature trees, attacking actively growing shoots and particularly the young expanding leaves where it is found in greatest numbers on the under surface.

The mites are minute, the body of the mature female being about 0.15 mm long and that of the adult male about 0.125 mm. The eggs, which measure 0.10 mm by 0.06 mm, are laid mostly along leaf veins; their surface is covered with a pattern of white spots which are just visible under a strong lens. Larvae are translucent white; young adults are yellow green and become darker with age. In the laboratory the egg stage lasts less than two days and the larval stage less than one. After a few hours in a quiescent state the larva changes directly to the adult. A single female can lay as many as eight eggs a day, starting on the second day of adult life and going on for seven days or more.

The injury caused by the mites' feeding punctures can be seen with the naked eye as a line of lighter green spots on each side of the veins. The whole leaf becomes paler, shrivels, and develops a wavy margin. Young plants may in severe cases become quite leafless through new leaves falling off in an early stage of development. In mature areas the pest attains its greatest prominence during the periods of annual refoliation when it becomes, with *Oidium heveae* and *Gloesporium alborubrum*, one of the factors causing secondary leaf fall.

Control — The yellow tea mite is generally controlled by its natural enemies. Insects as diverse as a ladybird beetle, the larva of a midge, and a species of thrips, feed on it; but the most effective predator is another mite. Chemical applications are best avoided as far as possible owing to the danger of destroying the predators, particularly the mite. Control measures may be locally necessary in immature areas where the pest has temporarily escaped from its enemies and is spreading. The recommended treatment is dusting with sulphur at intervals of about five days. In nurseries, application of the dust can conveniently be made with a hand operated rotary duster: suitable machines are produced by several manufacturers, some of whom have agents in Malaya.

Control measures are unlikely to be economic in mature areas, where a power duster would have to be employed, but if sulphur dusting were carried out to reduce *Oidium* attack it would also be effective against the mite.

This note supercedes advisory leaflet P/AL 3(52) of the Pathological Division.

PATHOLOGICAL DIVISION

Index 1952-3

Numerals in *italics* refer to pages in 1952 issues; ordinary roman numerals refer to 1953 issues. There were three issues only in 1952, when P B resumed publication, so it is seen fit to index these together with those of the full year 1953.

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R. R. I. Lectures to Planters

During 1954 it will be possible for the following lectures to be given by senior officers of the R.R.I. Divisions. The demand for such lectures during 1953 was considerable and we were unable to meet all requests. Early application, for not more than two fixtures, is therefore recommended and alternative choices should be given. Organisers are asked to avoid dates when other interests might diminish attendance. Thus Sunday is usually a bad day, and there is a brief period in the month when estates are occupied with 'advances', in some districts.

SOILS DIVISION

C.G. AKHURST: *Weed control*

G. OWEN: *Soils and the nutrition of the rubber tree*

BOTANICAL DIVISION

E.D.C. BAPTIST: *Problems of current interest on estates*
or *Improvement of yield in hevea*

H.M. BURKILL: *Clones and clonal seedlings*

C.W. BROOKSOON (after March:) *Plant breeding and testing*

P. DE JONGE (after June): *Yield stimulation*

PATHOLOGICAL DIVISION

A. NEWSAM: *Recognition of pests*
or *Termites and borers*

F.W. HUTCHISON: *Root diseases*
or *Spraying from the air*

R.N. HILTON: *Windborne diseases*

CHEMICAL DIVISION

L.L. BEST or P.F. MAHER: *Methods of technical classification in Malaya*

A.S. COOK: *Sheet, crepe and latex production*

H.M. EDMONDSON (after April): *Cyclised rubber manufacture*

Inquiry may be made of the Director.

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